EGU24-15174, updated on 11 Nov 2024
https://doi.org/10.5194/egusphere-egu24-15174
EGU General Assembly 2024

Using spatio-temporal neural networks to investigating teleconnections and enhance S2S forecasts of european extreme weather

Philine L. Bommer[1], Marlene Kretschmer[3,4], Paul Boehnke[1], and Marina M.-C. Hoehne née Vidovic[5]

[1]Understandable Machine Intelligence Lab, Technical University Berlin, Berlin, Germany (philine.bommer@protonmail.com)
[3]Leipzig Institute for Meteorology, University of Leipzig, Leipzig, Germany
[4]Department of Meteorology, University of Reading, Reading, UK
[5]Institute of Computer Science - University of Potsdam, Potsdam, Germany

Decision making and efficient early warning systems for extreme weather rely on subseasonal-to-seasonal (S2S) forecasts. However, the chaotic nature of the atmosphere impedes predictions by dynamical forecast systems on the S2S time scale. Improved predictability may arise due to remote drivers and corresponding teleconnections in so-called windows of opportunities, but using knowledge of such drivers to boost S2S forecast skill is challenging. Here, we present a spatio-temporal deep neural network (DNN), predicting a time series of weekly North Atlantic European (NAE) weather regimes on lead-times of one to six weeks during boreal winter. The spatio-temporal architecture combines a convolutional Long-short-term-memory (convLSTM) encoder with an Long-short-term-memory (LSTM) decoder and was built to consider both short and medium-range variability as information. As predictors it uses 2D (image) time series input data of expected drivers of European winter weather, including the stratospheric polar vortex and tropical sea surface temperatures, alongside the 1D time series of NAE regimes. Our results indicate that additional information provided in the image time series yield a skill score improvement for longer lead times. In addition, by analysing periods of enhanced or decreased predictability of the DNN, we can infer further information regarding prevalent teleconnections.